

Claims

- [c1] A method of forming a semiconductor structure, comprising:
- providing a substrate having a first semiconductor layer positioned on a first insulator layer, a second insulator layer positioned on said first semiconductor layer, and a second semiconductor layer positioned on said second insulator layer;
 - forming a first fin and a second fin in said second semiconductor layer;
 - masking said first fin; and
 - forming a third fin in said first semiconductor layer, wherein said second fin is stacked on said third fin.
- [c2] The method of claim 1, wherein the step of forming said first fin and said second fin comprises:
- depositing a hardmask layer on said second semiconductor layer;
 - patterning said hardmask layer; and
 - etching said second semiconductor layer to form said first fin and said second fin.
- [c3] The method of claim 2, wherein said etching of said second semiconductor layer stops when said second insula-

tor layer is reached.

- [c4] The method of claim 1, wherein the step of forming said third fin comprises:
depositing and developing a photoresist over said first fin; and
etching said second insulator layer and said first semiconductor layer to form said third fin.
- [c5] The method of claim 4, wherein said etching of said first semiconductor layer stops when said first insulator layer is reached.
- [c6] The method of claim 1, further comprising the steps of:
implanting a dopant into each of said fins;
forming a gate insulator layer on opposing sidewalls of each of said fins;
forming a gate conductor layer on said gate insulator layer;
patterning said gate conductor layer and said gate insulator layer; wherein said patterning forms gate stacks;
implanting a source region in a first exposed portion of each of said fins;
implanting a drain region in a second exposed portion of each of said fins, wherein said source and drain regions are separated by a channel region; and
forming contacts to said source region, said drain region

and said gate conductor layer.

[c7] The method of claim 6, wherein said contacts are formed by:

depositing a dielectric layer;

planarizing said dielectric layer;

etching openings in said planarized dielectric layer; and

filing said openings with a conducting material, wherein said filled openings form said contacts.

[c8] A semiconductor structure, comprising:

a semiconductor substrate having a first semiconductor layer positioned on a first insulator layer, a second insulator layer positioned on said first semiconductor layer, and a second semiconductor layer positioned on said second insulator layer;

a first and second fin formed in said second semiconductor layer; and

a third fin formed in said first semiconductor layer, wherein said second fin is stacked on said third fin.

[c9] The semiconductor structure of claim 8, wherein said stacked fins form a first finFET and said first fin forms a second finFET.

[c10] The semiconductor structure of claim 9, wherein said first finFET is a p-channel finFET and said second finFET

is a n-channel finFET.

- [c11] The semiconductor structure of claim 8, wherein said second semiconductor layer is bonded to said second insulator layer.
- [c12] The semiconductor structure of claim 8, wherein a height of said third fin corresponds to a thickness of said first semiconductor layer.
- [c13] The semiconductor structure of claim 12, wherein said first semiconductor layer thickness ranges approximately from 40 nm to 70 nm.
- [c14] The semiconductor structure of claim 8, wherein a height of said first fin and said second fin correspond to a thickness of said second semiconductor layer.
- [c15] The semiconductor structure of claim 14, wherein said second semiconductor layer thickness ranges approximately from 40 nm to 70 nm.
- [c16] The semiconductor structure of claim 8, wherein said first semiconductor layer has a surface oriented on a first crystal plane and said second semiconductor layer has a surface oriented on a second crystal plane.
- [c17] The semiconductor structure of claim 16, wherein a first mobility is associated with said first crystal plane and a

second mobility is associated with said second crystal plane, wherein said first mobility is different from said second mobility.

[c18] The semiconductor structure of claim 16, wherein sidewalls of said first and second fins are orientated on a {100} crystal plane and sidewalls of said third fin are oriented on a {110} crystal plane.

[c19] The semiconductor structure of claim 8, further comprising:
a dopant implanted into each of said fins;
a gate insulator layer formed on opposing sidewalls of each of said fins;
a gate conductor layer formed on said gate insulator layer, wherein said gate conductor layer and said gate insulator layer form gate stacks;
a source region implanted in a first exposed portion of each of said fins; and
a drain region implanted in a second exposed portion of each of said fins, wherein said source and drain regions are separated by a channel region.

[c20] A circuit, comprising:
a first semiconductor layer positioned on a first insulator layer;
a second insulator layer positioned on said first semi-

conductor layer;

a second semiconductor layer positioned on said second insulator layer;

a first and second fin formed in said second semiconductor layer; and

a third fin formed in said first semiconductor layer, wherein said second fin is stacked on said third fin.